CITY OF HAGERMAN (PWS 5240012) SOURCE WATER ASSESSMENT FINAL REPORT

April 15, 2003



State of Idaho Department of Environmental Quality

Disclaimer: This publication has been developed as part of an informational service for the source water assessments of public water systems in Idaho and is based on the data available at the time and the professional judgement of the staff. Although reasonable efforts have been made to present accurate information, no guarantees, including expressed or implied warranties of any kind, are made with respect to this publication by the State of Idaho or any of its agencies, employees, or agents, who also assume no legal responsibility for the accuracy of presentations, comments, or other information in this publication. The assessment is subject to modification if new data is produced.

Executive Summary

Under the Safe Drinking Water Act Amendments of 1996, all states are required by the U.S. Environmental Protection Agency (EPA) to assess every source of public drinking water for its relative sensitivity to contaminants regulated by the act. This assessment is based on a land use inventory of the designated assessment area, sensitivity factors associated with the well and Big Springs, and aquifer characteristics.

This report, *Source Water Assessment for the City of Hagerman, Idaho*, describes the public drinking water system (PWS), the boundaries of the zones of water contribution, and the associated potential contaminant sources located within these boundaries. This assessment should be used as a planning tool, taken into account with local knowledge and concerns, to develop and implement appropriate protection measures for this source. The results should <u>not be</u> used as an absolute measure of risk and they should <u>not be</u> used to undermine public confidence in the water system.

Final susceptibility scores for wells are derived from equally weighting system construction scores, hydrologic sensitivity scores, and potential contaminant/land use scores. Similarly, final spring susceptibility scores are derived from heavily weighting potential contaminant inventory/land use scores and adding them with system construction scores. Therefore, a low rating in one or two categories coupled with a higher rating in another category results in a final rating of low, moderate, or high susceptibility. With the potential contaminants associated with most urban and heavily agricultural areas, the best score a well or spring can get is moderate. Potential contaminants are divided into four categories, inorganic contaminants (IOCs, i.e. nitrates, arsenic), volatile organic contaminants (VOCs, i.e. petroleum products), synthetic organic contaminants (SOCs, i.e. pesticides), and microbial contaminants (i.e. bacteria). As different drinking water sources can be subject to various contamination settings, separate scores are given for each type of contaminant.

The City of Hagerman (PWS #5240012) drinking water system consists of a spring called Big Springs and a well. The water from Big Springs and the well is manifolded together. Both Big Springs and the well have an automatically high susceptibility to SOCs and moderate susceptibility to IOCs, VOCs, and microbial contaminants. In August 2000, the SOC pentachlorophenol was detected at the well/spring manifold. Any detection of a VOC or SOC at the well or spring source results in an automatic high susceptibility rating of the drinking water source to that contaminant category. Because it is impossible to discern if the SOC originated from the well or from Big Springs due to the manifold, both drinking water sources are rated automatically high for SOCs.

Both Big Springs and the well have moderate system construction scores and the well rated moderate for hydrologic sensitivity. The potential contaminant inventory/land use scores for Big Springs are moderate for IOCs, VOCs, and SOCs, and low for microbial contaminants. The potential contaminant inventory/land use scores for the well are low for all categories. The City of Hagerman drinking water sources are located in a county of high nitrogen fertilizer use, high herbicide use, and high ag-chemical use. However, the predominant land use of the area is classified as rangeland, a less potentially contaminating land use.

The most significant water chemistry issue for the City of Hagerman pertains to the detection of the SOC pentachlorophenol at the manifold of the well and Big Springs. In August 2000, pentachlorophenol was detected at 0.66 micrograms per liter (μ g/L). According to the Agency for Toxic Substances and Diseases Registry (ATSDR), pentachlorophenol is a restricted use pesticide and is also used as a wood preservative for railroad ties, wharf pilings, and utility poles. Exposure to high levels of the chemical can cause increases in body temperature, liver effects, damage to immune system, reproductive effects, and developmental effects.

Other chemicals detected in the water system include the IOCs arsenic, chromium, fluoride, and nitrate. All of these IOCs were detected at levels far below the maximum contaminant levels (MCLs). Alpha and beta particles (radionuclides) were also detected in the water system but at low levels. Total coliform bacteria have been detected in the distribution system occasionally between 1992 and 1995, and in October 1992, total coliform and fecal coliform bacteria were detected repeatedly. However, no recent detection of bacteria have occurred in the drinking water system. No VOCs have been detected in the water system thus far.

This assessment should be used as a basis for determining appropriate new protection measures or reevaluating existing protection efforts. No matter what ranking a source receives, protection is always important. Whether the source is currently located in a "pristine" area or an area with numerous industrial and/or agricultural land uses that require surveillance, the way to ensure good water quality in the future is to act now to protect valuable water supply resources. If the system should need to expand in the future, new well or spring sites should be located in areas with as few potential sources of contamination as possible, and the site should be reserved and protected for this specific use.

For the City of Hagerman, drinking water protection activities should first focus on maintaining the requirements of the sanitary survey (an inspection conducted every five years with the purpose of determining the physical condition of a water system's components and its capacity). Any spills from the potential contaminant sources listed in Tables 1 and 2 of this report should be carefully monitored, as should any future development in the delineated area. Other practices aimed at reducing the leaching of agricultural chemicals from agricultural land within the designated source water area should be implemented. Engineering controls may need to be implemented if any further SOC detection occurs. Also, disinfection practices should be maintained if microbial contamination becomes a problem. No chemicals should be stored or applied within the 50-foot radius of the wellhead. Most of the designated areas are outside the direct jurisdiction of the City of Hagerman, making partnerships with state and local agencies and industry groups critical to success of drinking water protection. Providing the appropriate agencies with a well log and construction plans concerning Big Springs may assist them in determining the drinking water protection needs for the City of Hagerman.

Due to the time involved with the movement of ground water, drinking water protection activities should be aimed at long-term management strategies even though these strategies may not yield results in the near term. A strong public education program should be a primary focus of any drinking water protection plan as the delineation is near urban and residential land use areas. Public education topics could include proper lawn and garden care practices, household hazardous waste disposal methods, proper care and maintenance of septic systems, and the importance of water conservation to name but a few. There are multiple resources available to help communities implement protection programs, including the Drinking Water Academy of the EPA. There are major transportation corridors through the delineation; therefore, the State Department of Transportation should be involved in protection activities. Drinking water protection activities for agriculture should be coordinated with the Idaho State Department of Agriculture, the Soil Conservation Commission, the local Soil Conservation District, and the Natural Resources Conservation Service.

A system must incorporate a variety of strategies in order to develop a comprehensive drinking water protection plan, be they regulatory in nature (i.e. zoning, permitting) or non-regulatory in nature (i.e. good housekeeping, public education, specific best management practices). For assistance in developing protection strategies please contact the Twin Falls Regional Office of the Idaho Department of Environmental Quality or the Idaho Rural Water Association.

SOURCE WATER ASSESSMENT FOR THE CITY OF HAGERMAN, IDAHO

Section 1. Introduction - Basis for Assessment

The following sections contain information necessary to understand how and why this assessment was conducted. It is important to review this information to understand what the rankings of this assessment mean. Maps showing the delineated source water assessment areas and the inventory of significant potential sources of contamination identified within those areas are attached. The lists of significant potential contaminant source categories and their rankings, used to develop this assessment, are also attached.

Level of Accuracy and Purpose of the Assessment

The Idaho Department of Environmental Quality (DEQ) is required by the EPA to assess the over 2,900 public drinking water sources in Idaho for their relative susceptibility to contaminants regulated by the Safe Drinking Water Act. This assessment is based on a land use inventory of the delineated assessment area, sensitivity factors associated with the wells, and aquifer characteristics. All assessments must be completed by May of 2003. The resources and time available to accomplish assessments are limited. Therefore, an in-depth, site-specific investigation to identify each significant potential source of contamination for every public water system is not possible. This assessment should be used as a planning tool, taken into account with local knowledge and concerns, to develop and implement appropriate protection measures for this source. The results should not be used as an absolute measure of risk and they should not be used to undermine public confidence in the water system.

The ultimate goal of this assessment is to provide data to local communities to develop a protection strategy for their drinking water supply system. The DEQ recognizes that pollution prevention activities generally require less time and money to implement than treating a public water supply system once it has been contaminated. DEQ encourages communities to balance resource protection with economic growth and development. The decision as to the amount and types of information necessary to develop a drinking water protection program should be determined by the local community based on its own needs and limitations. Drinking water protection is one facet of a comprehensive growth plan, and it can complement ongoing local planning efforts.

Section 2. Conducting the Assessment

General Description of the Source Water Quality

The City of Hagerman drinking water system includes a well and a spring that serve a population of 400 people through 450 connections. The well is located on East Hagerman Avenue approximately three-fourths of a mile east of State Street. Big Springs is located near Billingsley Creek in the canyon approximately three-eights of a mile above Tupper Grade (Figure 1). Water from Big Springs and the well is chlorinated with 11% hypochlorite solution before entering the 800,000-gallon glass lined steel tank. A chemical feed pump is used to measure the correct dosage for disinfection.

The most significant water chemistry issue for the City of Hagerman pertains to the detection of the SOC pentachlorophenol at the manifold of the well and Big Springs. In August 2000, pentachlorophenol was detected at $0.66~\mu g/L$. According to the ATSDR, pentachlorophenol is a restricted use pesticide and is also used as a wood preservative for railroad ties, wharf pilings, and utility poles. Exposure to high levels of the chemical can cause increases in body temperature, liver effects, damage to immune system, reproductive effects, and developmental effects.

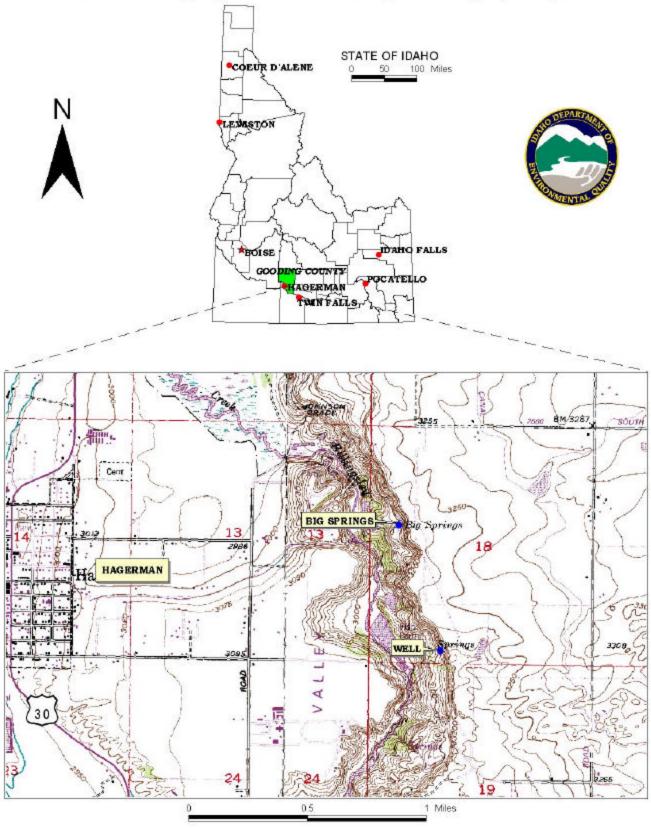
Other chemicals detected in the water system include the IOCs arsenic, chromium, fluoride, and nitrate. All of these IOCs were detected at levels far below the MCLs. Alpha and beta particles (radionuclides) were also detected in the water system but at low levels. Total coliform bacteria have been detected in the distribution system occasionally between 1992 and 1995, and in October 1992, total coliform and fecal coliform bacteria were detected repeatedly. However, no recent detection of bacteria have occurred in the drinking water system. No VOCs have been detected in the water system thus far. The well and spring are located in a county that has been rated high for nitrogen fertilizer use, herbicide use, and total agricultural chemical use.

Defining the Zones of Contribution – Delineation

The delineation process establishes the physical area around a well that will become the focal point of the assessment. The process includes mapping the boundaries of the zone of contribution into time-of-travel zones (zones indicating the number of years necessary for a particle of water to reach a well) for water in the aquifer. DEQ used a refined computer model approved by the EPA in determining the time-of-travel (TOT) zones for water associated with the Southwest Eastern Snake River Plain (SW ESRP) aquifer. The computer model used site-specific data, assimilated by DEQ from a variety of sources including local area well logs and hydrogeologic reports summarized below.

The ESRP is a northeast trending basin located in southeastern Idaho. The 10,000 square miles of the plain are filled primarily with highly fractured layered Quaternary basalt flows of the Snake River Group, which are intercalated with sedimentary rocks along the margins (Garabedian, 1992, p. 5). Individual basalt flows range from 10 to 50 feet thick, averaging 20 to 25 feet thick (Lindholm, 1996, p. 14). Basalt is thickest in the central part of the eastern plain and thins toward the margins. Whitehead (1992, p. 9) estimates the total thickness of the flows to be as great as 5,000 feet. A thin layer (0 to 100 feet) of windblown and fluvial sediments overlies the basalt.

FIGURE 1. Geographic Location of the City of Hagerman



The layered basalts of the Snake River Group host one of the most productive aquifers in the United States. The aquifer is generally considered unconfined, yet may be confined locally because of interbedded clay and dense unfractured basalt (Whitehead, 1992, p. 26). Whitehead (1992, p. 22) reports that well yields of 2,000 to 3,000 gal/min are common for wells open to less than 100 feet of the aquifer. Lindholm (1996, p. 18) estimates aquifer thickness to range from 100 feet near the plain's margin to thousands of feet near the center. Models of the regional aquifer have used values ranging from 200 to 3,000 feet to represent aquifer thickness (Cosgrove et al., 1999, p. 15).

Regional ground water flow is to the southwest paralleling the basin (Cosgrove et al., 1999; deSonneville, 1972, p. 78; Garabedian, 1992, p. 48; and Lindholm, 1996, p. 23). Reported water table gradients range from 3 to 100 ft/mile and average 12 ft/mile (Lindholm, 1996, p. 22). Gradients steepen at the plain's margin and at discharge locations.

The majority of aquifer recharge results from surface water irrigation activities (incidental recharge), which divert water from the Snake River and its tributaries (Ackerman, 1995, p. 4, and Garabedian, 1992, p. 11). Natural recharge occurs through stream losses, direct precipitation, and tributary basin underflow.

The Southwest Margin of the ESRP hydrologic province is the regional aquifer's primary discharge area. Interpretation of well logs indicates that a 1- to 23-foot-thick layer of sediment overlies the fractured basalt aquifer in Jerome County, and that an 8- to 410-foot-thick layer of sediment overlies the same aquifer in southern Minidoka and Power Counties. Published geologic maps of the Snake River Plain (Whitehead 1992, Plates 1 and 5) indicate there is 100 to 500 feet of Quaternary to Tertiary Basalt aged compacted to poorly consolidated sediments located in the Heyburn area (north of the Snake River near Burley). The saturated thickness of the regional basalt aquifer for the Southwest Margin is estimated to range from less than 500 feet near the Snake River to 1,500 feet near Minidoka.

A published water table map of the Kimberly to Bliss region of the aquifer (Moreland, 1976, p. 5) indicates that the ground-water flow direction in the Southwest Margin is similar to that depicted at the regional scale (e.g., Garabedian, 1992, Plate 4).

Annual average precipitation for the period 1951 to 1980 is 9.6 inches in both Twin Falls and Burley (Kjelstrom, 1995, p. 3). The estimated recharge from precipitation in the Southwest Margin ranges from less than 0.5 inch to more than 2 in./yr (Garabedian, 1992, p. 20). Kjelstrom (1995, p. 13) reports an annual river loss of 110,000 acre-feet to the aquifer for the 34.8-mile Minidoka-to-Milner reach of the Snake River. River gains of 210,000 acre-feet for the 21.5-mile Milner-to-Kimberly reach, and 880,000 acre-feet for the 20.4-mile Kimberly-to-Buhl reach are reported for the same period.

Capture Zone Modeling

Capture zone delineations for all of the City of Wendell sources and the Big Spring source for the City of Hagerman were modeled using the MODFLOW numerical groundwater flow model and the MODPATH particle-tracking model. The ground water well source for the City of Hagerman was modeled using the analytical ground water model WHAEM, version 2.0.3 beta because, based on its static water elevation and completion details, it appears to draw water from a deeper portion of the Eastern Snake Plain aquifer. The MODFLOW model used for the other sources is only intended to simulate the uppermost-saturated 200 feet of the aquifer.

A preexisting MODFLOW model, developed by Wicherski (Baldwin et al., 2000) to examine TOT to the springs discharging from the aquifer in this vicinity, was used to develop the TOT capture zones for the City of Wendell well sources and the City of Hagerman spring source. The model inputs used in the original model were not changed. For the City of Hagerman spring source, since only a portion of the total Big Spring flow is used by the city, the capture zone delineated was based on the total flow at the springs. This flow was simulated by a placing a series of wells in the vicinity of the springs and dividing the reported flow equally among the wells. For this reason the capture zone delineated is likely conservative in size.

Model inputs for the WHAEM model used for the Hagerman ground water well include: 2,870 to 5,494 feet/day for hydraulic conductivity, an effective porosity of 0.20, an aquifer thickness of 200 feet, and zero recharge. Because the static water elevation in the well is below the discharge elevation of the major springs in the area it was assumed that the local discharge point for this portion of the ground water system was the Snake river. A constant head boundary was used in this vicinity equal to the river elevation. No areal recharge was included in the model. This was done based on an assumption of horizontal flow in the aquifer along with a significant saturated thickness above the portion of the aquifer simulated for this well. The hydraulic relationships between various depth intervals of the East Snake Plain Aquifer are not well understood. Another assumption in this simulation was that the hydraulic properties of this portion of the aquifer, specifically the hydraulic conductivity distribution, was similar to that found in the portion of the aquifer above it. As a consequence several of the major hydraulic conductivity zones used in the MODFLOW model were duplicated in the WHAEM model.

Following operator comment regarding the original delineations only having 3- and 6-year TOT zones, additional delineation work was conducted to extend the original TOT capture zones developed for the City of Hagerman public drinking water sources to the full 3-, 6-, and 10-year boundaries. The boundaries of the original MODFLOW and WHAEM models that were used (described above) did not permit this. An evaluation was conducted to determine how to most efficiently extend the capture zones. It was determined that rather than expend significant effort in building and calibrating new models that would take in the larger model domain required for the longer capture zones that were anticipated it was decided to use an existing model that met these needs.

The model used is the United States Geological Survey (USGS) MODFLOW model of the Eastern Snake River Plain developed by Garabedian (1992). This model has been well tested and calibrated to aquifer water levels. The model input files were obtained from Dave Clark of the Boise USGS Office. The primary modification of the original Garabedian model provided by Mr. Clark was that the discritization of the model grid had been increased. The original Garabedian model contained grid blocks that were four miles square. The finer grid used in this modeling contained grid blocks one mile square in size.

Wells corresponding to the sources being modeled for each city were placed in grid blocks corresponding as closely as possible to their location. The original input values for pumping rates and pumping scenarios were also used. For the City of Hagerman Big Spring source no pumping was employed. The pathlines generated by MODPATH for each well location were modified slightly to reflect the actual measured ground water potentiometric surface for the Eastern Snake Plain aquifer. In addition, the widths of capture zones were modified to acknowledge 1) the constraints of using a numerical model with a grid block size that is coarser than ideal for looking at pumping of individual wells and 2) the uncertainty in flow paths at the large distances (up to 30 miles) from the pumping wells seen for the longer TOT capture zones.

The final amended capture zones for the City of Hagerman sources are illustrated in Figures 2 and 3. The general shape and direction of the delineations is similar to those originally developed. A major difference in the amended delineations is the shortened lengths, for a given time period, of the new capture zone delineations. This change is a result of the lower hydraulic conductivity values employed in the USGS model versus the earlier DEQ model. For a given pumping rate this results in shorter but wider capture zones. In a fast moving, productive aquifer such as the Eastern Snake Plain calculated capture zone widths for wells pumping at the relatively low rates assumed for these sources are very small (several hundred feet at most). Therefore, the capture zone widths as delineated are likely very conservative but reflect the uncertainty inherent in attempting to model a complex groundwater flow system such as the Eastern Snake Plain.

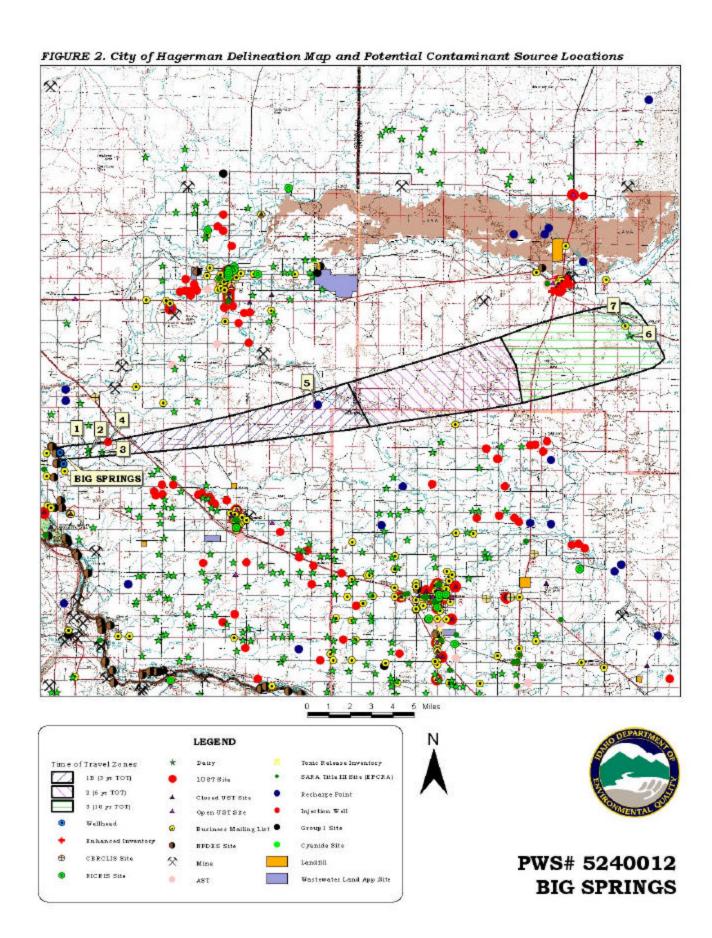
The City of Hagerman well delineation can best be described as a long, thin corridor extending approximately 27 miles to the east-northeast. The City of Hagerman spring delineation can best be described as a long, thin corridor extending approximately 28 miles to the east-northeast. Big Springs delienation is about 4 miles wide at the end whereas the well delineation is only about 1 mile wide at the end (Figures 2 and 3). The actual data used in determining the source water assessment delineation area is available from DEQ upon request.

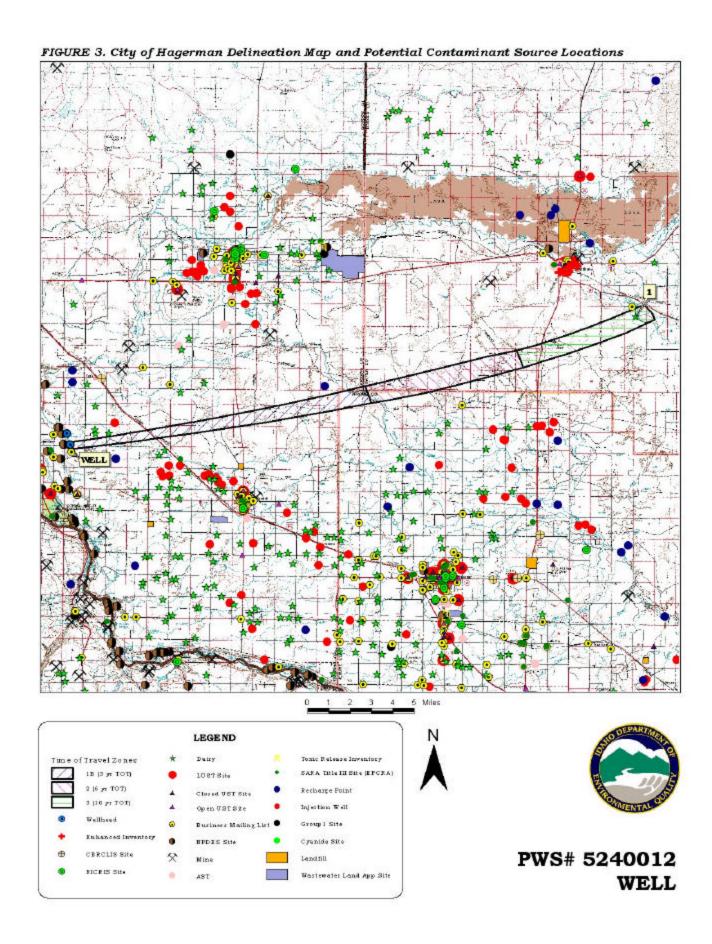
Identifying Potential Sources of Contamination

A potential source of contamination is defined as any facility or activity that stores, uses, or produces, as a product or by-product, the contaminants regulated under the Safe Drinking Water Act and has a sufficient likelihood of releasing such contaminants at levels that could pose a concern relative to drinking water sources. The goal of the inventory process is to locate and describe those facilities, land uses, and environmental conditions that are potential sources of ground water contamination. The locations of potential sources of contamination within the delineation area were obtained by field surveys conducted by DEQ and the City of Hagerman and from available databases.

The dominant land use outside the area of the City of Hagerman is predominantly irrigated agriculture and rangeland. Land use within the immediate area of the wellhead consists of residential property and rangeland.

It is important to understand that a release may never occur from a potential source of contamination provided best management practices are used at the facility. Many potential sources of contamination are regulated at the federal level, state level, or both, to reduce the risk of release. Therefore, when a business, facility, or property is identified as a potential contaminant source, this should not be interpreted to mean that this business, facility, or property is in violation of any local, state, or federal environmental law or regulation. What it does mean is that the <u>potential</u> for contamination exists due to the nature of the business, industry, or operation. There are a number of methods that water systems can use to work cooperatively with potential sources of contamination, such as educational visits and inspections of stored materials. Many owners of such facilities may not even be aware that they are located near a public water supply well.





Contaminant Source Inventory Process

A contaminant inventory of the study area was conducted in December 2002 of January 2003. This involved identifying and documenting potential contaminant sources within the City of Hagerman Source Water Assessment Area through the use of computer databases and Geographic Information System maps developed by DEQ.

The well delineation contains 1 potential point source (Table 1) and the spring delineation contains 7 potential point sources (Table 2). These potential contaminant sources include a deep injection well, a few dairies, and a livestock feeding business.

The GIS map shows that Interstate 84 and US Highway 93 cross the delineations in the 3-year and 10-year TOTs, respectively. These are major transportation corridors that can contaminate the aquifer in the event of an accidental spill or release.

Table 1. City of Hagerman, Well Potential Contaminant Inventory

SITE	Source Description ¹	TOT ² ZONE	Source of Information	Potential Contaminants ³
	Interstate 84	0 - 3	GIS Map	IOC, VOC, SOC, Microbials
1	Dairy <= 200 cows	6 – 10	Database Search	IOC
	US Highway 93	6 – 10	GIS Map	IOC, VOC, SOC

²TOT = time-of-travel (in years) for a potential contaminant to reach the wellhead

Table 2. City of Hagerman, Spring Potential Contaminant Inventory

SITE	Source Description ¹	TOT ² ZONE	Source of Information	Potential Contaminants ³
1	Dairy: 201-500 cows	0 – 3	Database Search	IOC, Microbials
2	Dairy: 1001-2000 cows	0 - 3	Database Search	IOC, Microbials
3	Dairy <=200 cows	0 - 3	Database Search	IOC, Microbials
4	Deep Injection Well-Active	0 - 3	Database Search	IOC, VOC, SOC, Microbials
5	Recharge point-Proposed	0 - 3	Database Search	IOC, VOC, SOC, Microbials
	Interstate 84	0 - 3	GIS Map	IOC, VOC, SOC, Microbials
6	Dairy <=200 cows	6 – 10	Database Search	IOC
7	Livestock Feeding	6 – 10	Database Search	IOC
	US Highway 93	6 – 10	GIS Map	IOC, VOC, SOC

²TOT = time-of-travel (in years) for a potential contaminant to reach the wellhead

Section 3. Susceptibility Analyses

The susceptibility of each drinking water source to contamination was ranked as high, moderate, or low risk according to the following considerations: hydrologic characteristics (well only), physical integrity of the well, land use characteristics, and potentially significant contaminant sources. The susceptibility rankings are specific to a particular potential contaminant or category of contaminants. Therefore, a high susceptibility rating relative to one potential contaminant does not mean that the water system is at the same risk for all other potential contaminants. The relative ranking that is derived for each drinking water source is a qualitative, screening-level step that, in many cases, uses generalized assumptions and best professional judgement. Appendix A contains the susceptibility analysis worksheets. The following summaries describe the rationale for the susceptibility ranking.

³ IOC = inorganic chemical, VOC = volatile organic chemical, SOC = synthetic organic chemical

³ IOC = inorganic chemical, VOC = volatile organic chemical, SOC = synthetic organic chemical

Hydrologic Sensitivity

The hydrologic sensitivity of a well is dependent upon four factors: the surface soil composition, the material in the vadose zone (between the land surface and the water table), the depth to first ground water, and the presence of a 50-foot thick fine-grained zone above the producing zone of the well. Slowly draining soils such as silt and clay typically are more protective of ground water than coarse-grained soils such as sand and gravel. Similarly, fine-grained sediments in the subsurface and a water depth of more than 300 feet protect the ground water from contamination.

The hydrologic sensitivity was moderate for the well (see Table 3). This rating reflects the poor- to moderately drained nature of the soil of the region, which potentially decreases the downward movement of contaminants. However, the well log for the well was unavailable, preventing a determination of the composition of the vadose zone, the depth to first ground water or the presence of low permeable geologic units above the producing zone.

Well Construction

Well construction directly affects the ability of the well to protect the aquifer from contaminants. System construction scores are reduced when information shows that potential contaminants will have a more difficult time reaching the intake of the well. Lower scores imply a system is less vulnerable to contamination. For example, if the well casing and annular seal both extend into a low permeability unit, then the possibility of contamination is reduced and the system construction score goes down. If the highest production interval is more than 100 feet below the water table, then the system is considered to have better buffering capacity. If the wellhead and surface seal are maintained to standards, as outlined in sanitary surveys, then contamination down the well bore is less likely. If the well is protected from surface flooding and is outside the 100-year floodplain, then contamination from surface events is reduced.

The well log for the City of Hagerman well was not available, making it difficult to determine the diameter and thickness of the casing(s), the placement of the annular seal and the casing, and the highest production zone of the well. However, the 2001 sanitary survey does indicate that the static water level is found at 270 feet below ground surface (bgs) with a drawdown of 308 feet bgs and that the pump was placed at 320 feet bgs.

The system construction of the well was rated as moderately susceptible to contamination. Though the well log was unavailable limiting the amount of construction information, the 2001 sanitary survey does indicate that the wellhead and surface seals are maintained to standards, the well does have an adequate casing vent, and the well is properly protected from surface flooding. It is also located outside a 100-year flood plain.

Though the well of the City of Hagerman may have met standards at the time of construction, current well construction standards are stricter. The Idaho Department of Water Resources *Well Construction Standards Rules* (1993) require all Public Water Systems (PWSs) to follow DEQ standards as well. IDAPA 58.01.08.550 requires that PWSs follow the *Recommended Standards for Water Works* (1997) during construction. Some of the requirements include casing thickness, well tests, and depth and formation type that the surface seal must be installed into. Table 1 of the *Recommended Standards for Water Works* (1997) lists the required steel casing thickness for various diameter wells. In this case, there was insufficient information available to determine if the wells meet all the criteria outlined in the IDWR Well Construction Standards.

Spring Construction

Spring construction scores are determined by evaluating whether the spring has been constructed according to Idaho Code (IDAPA 58.01.08.04) and if the spring's water is exposed to any potential contaminants from the time it exits the bedrock to when it enters the distribution system. If the spring's intake structure, infiltration gallery, and housing are located and constructed in such a manner as to be permanent and protect it from all potential contaminants, is contained within a fenced area of at least 100 feet in radius, and is protected from all surface water by diversions, berms, etc., then Idaho Code is being met and the score will be lower. If the spring's water comes in contact with the open atmosphere before it enters the distribution system, it receives a higher score. Likewise, if the spring's water is piped directly from the bedrock to the distribution system or is collected in a protected spring box without any contact to potential surface-related contaminants, the score is lower.

Big Springs rated moderate for system construction (Table 3). Big Springs is located about 70 feet below a rim edge. A concrete structure collects the water that comes from the spring wall and coveys the water about thirty feet into the inlet structure of the pipeline that goes to the manifold. Though the water is never exposed to the atmosphere, it is unknown if the spring perimeter of 100-feet is protected by a fence to prohibit access to Big Springs. The owner of the land that Big Springs is located is also unknown.

Potential Contaminant Source and Land Use

The well rated low for IOCs (e.g. arsenic, nitrate), VOCs (e.g. petroleum products), SOCs (e.g. pesticides), and microbial contaminants (e.g. bacteria). Big Springs rated moderate for IOCs, VOCs, and SOCS, and low for microbial contaminants. The small number of potential contaminants in the well delineation area contributed to the low scores. The dairies located within the Big Springs delineation contributed to the higher scores. In addition, the high nitrogen fertilizer use, herbicide use, and total ag-chemical use of the county, as well as the irrigated agricultural land contributed to the potential contaminant inventory/land use scores.

Final Susceptibility Rating

An IOC detection above a drinking water standard MCL, any detection of a VOC or SOC, or a detection of total coliform bacteria or fecal coliform bacteria at the drinking water source automatically give a high susceptibility rating to a well or a spring, no matter what the land use of the area is. This is because a pathway for contamination already exists. In this case, the SOC pentachlorophenol was detected at the manifold of the well and Big Springs, resulting in an automatic high susceptibility score for SOCs for both the well and Big Springs. Additionally, the storage or application of any potential contaminants within 50 feet of the wellhead will automatically lead to a high score. Hydrologic sensitivity and system construction scores are heavily weighted in the final scores for the well. Having multiple potential contaminant sources in the 0- to 3-year time-of-travel zone (Zone 1B) and much agricultural land contribute greatly to the overall ranking. In terms of total susceptibility, the City of Hagerman well and spring rated high for SOCs and moderate for IOCs, VOCs, and microbial contaminants.

Table 3. Summary of the City of Hagerman Susceptibility Evaluation

	Susceptibility Scores ¹												
	Hydrologic Sensitivity	Contaminant Inventory							System Construction	Final Susceptibility Ranking			
Source		IOC	VOC	SOC	Microbials		IOC	VOC	SOC	Microbials			
Well	M	L	L	L	L	M	M	M	H*	M			
Spring	N/A	M	M	M	L	M	M	M	H*	M			

¹H = High Susceptibility, M = Moderate Susceptibility, L = Low Susceptibility, N/A = Not Applicable IOC = inorganic chemical, VOC = volatile organic chemical, SOC = synthetic organic chemical

Susceptibility Summary

In terms of total susceptibility, both Big Springs and the well have an automatically high susceptibility to SOCs and moderate susceptibility to IOCs, VOCs, and microbial contaminants. In August 2000, the SOC pentachlorophenol was detected at the well/spring manifold. Any detection of a VOC or SOC at the well or spring source results in an automatic high susceptibility rating of the drinking water source to that contaminant category. Because it is impossible to discern if the SOC originated from the well or from Big Springs due to the manifold, both drinking water sources are rated automatically high for SOCs.

Both Big Springs and the well have moderate system construction scores and the well rated moderate for hydrologic sensitivity. The potential contaminant inventory/land use scores for Big Springs are moderate for IOCs, VOCs, and SOCs, and low for microbial contaminants. The potential contaminant inventory/land use scores for the well are low for all categories. The City of Hagerman drinking water sources are located in a county of high nitrogen fertilizer use, high herbicide use, and high ag-chemical use. However, the predominant land use of the area is classified as rangeland, a less potentially contaminating land use.

The most significant water chemistry issue for the City of Hagerman pertains to the detection of the SOC pentachlorophenol at the manifold of the well and Big Springs. In August 2000, pentachlorophenol was detected at 0.66µg/L. According to the ATSDR, pentachlorophenol is a restricted use pesticide and is also used as a wood preservative for railroad ties, wharf pilings, and utility poles. Exposure to high levels of the chemical can cause increases in body temperature, liver effects, damage to immune system, reproductive effects, and developmental effects.

Other chemicals detected in the water system include the IOCs arsenic, chromium, fluoride, and nitrate. All of these IOCs were detected at levels far below the MCLs. Alpha and beta particles (radionuclides) were also detected in the water system but at low levels. Total coliform bacteria have been detected in the distribution system occasionally between 1992 and 1995, and in October 1992, total coliform and fecal coliform bacteria were detected repeatedly. However, no recent detection of bacteria have occurred in the drinking water system. No VOCs have been detected in the water system thus far. The well and spring are located in a county that has been rated high for nitrogen fertilizer use, herbicide use, and total agricultural chemical use.

^{* =} Automatic high susceptibility rating due to the detection of pentachlorophenol

Section 4. Options for Drinking Water Protection

The susceptibility assessment should be used as a basis for determining appropriate new protection measures or re-evaluating existing protection efforts. No matter what the susceptibility ranking a source receives, protection is always important. Whether the source is currently located in a "pristine" area or an area with numerous industrial and/or agricultural land uses that require surveillance, the way to ensure good water quality in the future is to act now to protect valuable water supply resources.

An effective drinking water protection program is tailored to the particular local drinking water protection area. A community with a fully developed drinking water protection program will incorporate many strategies, be they regulatory in nature (i.e. zoning, permitting) or non-regulatory in nature (i.e. good housekeeping, public education, specific best management practices). For the City of Hagerman, drinking water protection activities should first focus on maintaining the requirements of the sanitary survey. Any spills from the potential contaminant sources listed in Tables 1 and 2 of this report should be carefully monitored, as should any future development in the delineated area. Other practices aimed at reducing the leaching of agricultural chemicals from agricultural land within the designated source water area should be implemented. Engineering controls may need to be implemented if any further SOC detection occurs. Also, disinfection practices should be maintained if microbial contamination becomes a problem. No chemicals should be stored or applied within the 50foot radius of the wellhead. Most of the designated areas are outside the direct jurisdiction of the City of Hagerman, making partnerships with state and local agencies and industry groups critical to success of drinking water protection. Providing the appropriate agencies with a well log and construction plans concerning Big Springs may assist them in determining the drinking water protection needs for the City of Hagerman.

Due to the time involved with the movement of ground water, drinking water protection activities should be aimed at long-term management strategies even though these strategies may not yield results in the near term. A strong public education program should be a primary focus of any drinking water protection plan as the delineations are near urban and residential land use areas. There are multiple resources available to help communities implement protection programs, including the Drinking Water Academy of the EPA. There are major transportation corridors that cross the delineations; therefore, the State Department of Transportation should be involved in protection activities. Drinking water protection activities for agriculture should be coordinated with the Idaho State Department of Agriculture, the Soil Conservation Commission, the local Soil Conservation District, and the Natural Resources Conservation Service.

A system must incorporate a variety of strategies in order to develop a comprehensive drinking water protection plan, be they regulatory in nature (i.e. zoning, permitting) or non-regulatory in nature (i.e. good housekeeping, public education, specific best management practices). For assistance in developing protection strategies please contact the Twin Falls Regional Office of the Idaho Department of Environmental Quality or the Idaho Rural Water Association.

Assistance

Public water suppliers and others may call the following DEQ offices with questions about this assessment and to request assistance with developing and implementing a local protection plan. In addition, draft protection plans may be submitted to the DEQ office for preliminary review and comments.

Twin Falls Regional DEQ Office (208) 736-2190

State DEQ Office (208) 373-0502

Website: http://www.deq.state.id.us

Water suppliers serving fewer than 10,000 persons may contact Melinda Harper (mlharper@idahoruralwater.com), Idaho Rural Water Association, at 1-208-343-7001 for assistance with drinking water protection (formerly wellhead protection) strategies.

POTENTIAL CONTAMINANT INVENTORY LIST OF ACRONYMS AND DEFINITIONS

<u>AST (Aboveground Storage Tanks)</u> – Sites with aboveground storage tanks.

<u>Business Mailing List</u> – This list contains potential contaminant sites identified through a yellow pages database search of standard industry codes (SIC).

<u>CERCLIS</u> – This includes sites considered for listing under the <u>Comprehensive Environmental Response Compensation and Liability Act (CERCLA)</u>. CERCLA, more commonly known as Superfund is designed to clean up hazardous waste sites that are on the national priority list (NPL).

<u>Cyanide Site</u> – DEQ permitted and known historical sites/facilities using cyanide.

<u>Dairy</u> – Sites included in the primary contaminant source inventory represent those facilities regulated by Idaho State Department of Agriculture (ISDA) and may range from a few head to several thousand head of milking cows.

<u>Deep Injection Well</u> – Injection wells regulated under the Idaho Department of Water Resources generally for the disposal of stormwater runoff or agricultural field drainage.

Enhanced Inventory – Enhanced inventory locations are potential contaminant source sites added by the water system. These can include new sites not captured during the primary contaminant inventory, or corrected locations for sites not properly located during the primary contaminant inventory. Enhanced inventory sites can also include miscellaneous sites added by the Idaho Department of Environmental Quality (DEQ) during the primary contaminant inventory.

<u>Floodplain</u> – This is a coverage of the 100year floodplains.

<u>Group 1 Sites</u> – These are sites that show elevated levels of contaminants and are not within the priority one areas.

<u>Inorganic Priority Area</u> – Priority one areas where greater than 25% of the wells/springs show constituents higher than primary standards or other health standards.

<u>Landfill</u> – Areas of open and closed municipal and non-municipal landfills.

<u>LUST</u> (<u>Leaking Underground Storage Tank</u>) – Potential contaminant source sites associated with leaking underground storage tanks as regulated under RCRA.

<u>Mines and Quarries</u> – Mines and quarries permitted through the Idaho Department of Lands.

<u>Nitrate Priority Area</u> – Area where greater than 25% of wells/springs show nitrate values above 5 mg/l.

NPDES (National Pollutant Discharge Elimination System) – Sites with NPDES permits. The Clean Water Act requires that any discharge of a pollutant to waters of the United States from a point source must be authorized by an NPDES permit.

<u>Organic Priority Areas</u> – These are any areas where greater than 25% of wells/springs show levels greater than 1% of the primary standard or other health standards.

Recharge Point – This includes active, proposed, and possible recharge sites on the Snake River Plain.

RICRIS – Site regulated under **Resource Conservation Recovery Act (RCRA)**. RCRA is commonly associated with the cradle to grave management approach for generation, storage, and disposal of hazardous wastes.

SARA Tier II (Superfund Amendments and Reauthorization Act Tier II Facilities) – These sites store certain types and amounts of hazardous materials and must be identified under the Community Right to Know Act.

<u>Toxic Release Inventory (TRI)</u> – The toxic release inventory list was developed as part of the Emergency Planning and Community Right to Know (Community Right to Know) Act passed in 1986. The Community Right to Know Act requires the reporting of any release of a chemical found on the TRI list.

<u>UST</u> (<u>Underground Storage Tank</u>) – Potential contaminant source sites associated with underground storage tanks regulated as regulated under RCRA.

<u>Wastewater Land Applications Sites</u> – These are areas where the land application of municipal or industrial wastewater is permitted by DEQ.

<u>Wellheads</u> – These are drinking water well locations regulated under the Safe Drinking Water Act. They are not treated as potential contaminant sources.

NOTE: Many of the potential contaminant sources were located using a geocoding program where mailing addresses are used to locate a facility. Field verification of potential contaminant sources is an important element of an enhanced inventory.

Where possible, a list of potential contaminant sites unable to be located with geocoding will be provided to water systems to determine if the potential contaminant sources are located within the source water assessment area.

References Cited

Ackerman, D.J., 1995, *Analysis of Steady-State Flow and Advective Transport in the Eastern Snake River Plain Aquifer System, Idaho*, U.S. Geological Survey Water-Resources Investigations Report 94-4257, 25 p. I-FY95.

Baldwin J., D. Brandt, E. Hagan, and B. Wicherski, 2000, *Cumulative Impacts Assessment, Thousand Springs Area of the Eastern Snake River Plain, Idaho*, Idaho Department of Environmental Quality, Ground Water Quality Technical Report No. 14, 56 pp.

Cosgrove, D.M., G.S. Johnson, S. Laney, and J, Lindgren, 1999, *Description of the IDWR/UI Snake River Plain Aquifer Model (SRPAM)*, Idaho Water Resources Research Institute, University of Idaho, 95 p.

deSonneville, J.L.J, 1972, *Development of a Mathematical Groundwater Model*, Water Resources Research Institute, University of Idaho, Moscow, Idaho, 227 p.

Garabedian, S.P., 1992, *Hydrology and Digital Simulation of the Regional Aquifer System, Eastern Snake River Plain, Idaho*, U.S. Geological Survey Professional Paper 1408-F, 102 p., 10 pl. I-FY92.

Great Lakes-Upper Mississippi River Board of State and Provincial Public Health and Environmental Managers, 1997. "Recommended Standards for Water Works."

Idaho Department of Environmental Quality, 1997. *Design Standards for Public Drinking Water Systems*. IDAPA 58.01.08.550.01.

Idaho Department of Water Resources, 1993. *Administrative Rules of the Idaho Water Resource Board: Well Construction Standards Rules*. IDAPA 37.03.09.

Kjelstrom, L.C., 1995, Streamflow Gains and Losses in the Snake River and Ground-Water Budgets for the Snake River Plain, Idaho and Eastern Oregon, U.S. Geological Survey Professional Paper 1408-C, 47 p. I-FY95.

Lindholm, G.F., 1996, Summary of the Snake River Plain Regional Aquifer-System analysis in Idaho and Eastern Oregon, U.S. Geological Survey Professional Paper 1408-A, 59 p.

Moreland, J.A., 1976, Digital-Model Analysis of the Effects of Water-Use Alternatives on Spring Discharges, Gooding and Jerome Counties, Idaho, U.S. Geological Survey and Idaho Department of Water Resources, Water Information Bulletin No.42, 46p.

Whitehead, R.L., 1992, Geohydrologic Framework of the Snake River Plain Regional Aquifer System, Idaho and Eastern Oregon, U.S. Geological Survey Professional Paper 1408-B, 32p. I-FY92

Appendix A

City of Hagerman Susceptibility Analysis Worksheets

Susceptibility Analysis Formulas

Formula for Well Sources

The final scores for the susceptibility analysis were determined using the following formulas:

- 1) VOC/SOC/IOC Final Score = Hydrologic Sensitivity + System Construction + (Potential Contaminant/Land Use x 0.2)
- 2) Microbial Final Score = Hydrologic Sensitivity + System Construction + (Potential Contaminant/Land Use x 0.35)

Final Susceptibility Scoring:

- 0 5 Low Susceptibility
- 6 12 Moderate Susceptibility
- ≥ 13 High Susceptibility

Formula for Spring Sources

The final spring scores for the susceptibility analysis were determined using the following formulas:

- 1. VOC/SOC/IOC/ Final Score = (Potential Contaminant/Land Use X 0.6) + System Construction
- 2. Microbial Final Score = (Potential Contaminant/Land Use X 1.125) + System Construction

Final Susceptibility Scoring:

- 0 7 Low Susceptibility
- 8 15 Moderate Susceptibility
- ≥ 16 High Susceptibility

Public Water System Number 5240012

1. System Construction		SCORE			
Drill Date	1/1/1900				
Driller Log Available	NO				
Sanitary Survey (if yes, indicate date of last survey) Well meets IDWR construction standards	YES NO	2001 1			
Well meets ibwk construction standards Wellhead and surface seal maintained	YES	0			
Casing and annular seal extend to low permeability unit	NO	2			
Highest production 100 feet below static water level	NO	1			
Well located outside the 100 year flood plain	YES	0			
	Total System Construction Score	4			
2. Hydrologic Sensitivity					
Soils are poorly to moderately drained	YES	0			
Vadose zone composed of gravel, fractured rock or unknown	YES	1			
Depth to first water > 300 feet	NO	1			
Aquitard present with > 50 feet cumulative thickness	NO	2			
	Total Hydrologic Score	4			
		IOC	VOC	SOC	Microbia
3. Potential Contaminant / Land Use - ZONE 1A		Score	Score	Score	Score
Land Use Zone 1A	RANGELAND, WOODLAND, BASALT	0	0	0	0
Farm chemical use high	YES	2	0	2	
IOC, VOC, SOC, or Microbial sources in Zone 1A Total Potentia	YES al Contaminant Source/Land Use Score - Zone 1A	NO 2	0 NO	YES 2	NO 0
Potential Contaminant / Land Use - ZONE 1B					
Contaminant sources present (Number of Sources)	YES	2	2	2	2
(Score = # Sources X 2) 8 Points Maximum	123	4	4	4	4
Sources of Class II or III leacheable contaminants or	YES	2	2	2	-
4 Points Maximum		2	2	2	
Zone 1B contains or intercepts a Group 1 Area	NO	0	0	0	0
Land use Zone 1B	Less Than 25% Agricultural Land	0	0	0	0
Total Potential	Contaminant Source / Land Use Score - Zone 1B	6	6	6	4
Potential Contaminant / Land Use - ZONE II					
Contaminant Sources Present	NO	0	0	0	
Sources of Class II or III leacheable contaminants or	NO	0	0	0	
Land Use Zone II	Less than 25% Agricultural Land	0	0	0	
Potential C	Contaminant Source / Land Use Score - Zone II	0	0	0	0
Potential Contaminant / Land Use - ZONE III					
Contaminant Source Present	YES	1	1	1	
Sources of Class II or III leacheable contaminants or	YES	1	1	1	
Is there irrigated agricultural lands that occupy > 50% of	NO	0	0	0	
	Contaminant Source / Land Use Score - Zone III	2	2	2	0
Cumulative Potential Contaminant / Land Use Score		10	8	10	4
4. Final Susceptibility Source Score		10	10	10	10
5. Final Well Ranking		Moderate	Moderate	High	Moderate

4/2/2003 9:46:58 AM

Ground Water Susceptibility Report Public Water System Name : HAGERMAN CITY OF

Well# : BIG SPRINGS Public Water System Number 5240012 4/2/2003 9:49:10 AM

. System Construction		SCORE			
Intake structure properly constructred	NO	1			
Infiltration gallery or well					
under the direct influence of Surface Water	YES	0			
	Total System Construction Score	1			
. Potential Contaminant / Land Use - ZONE 1A		IOC Score	VOC Score	SOC Score	Microbi
Land Use Zone 1A	RANGELAND, WOODLAND, BASALT	 0	 0		 0
Farm chemical use high	YES	2	0	2	U
IOC, VOC, SOC, or Microbial sources in Zone 1A	YES	NO	NO	YES	NO
	Contaminant Source/Land Use Score - Zone 1A	2	0	2	0
Potential Contaminant / Land Use - ZONE 1B					
Contaminant sources present (Number of Sources)	YES	 7	4	4	 7
(Score = # Sources X 2) 8 Points Maximum		8	8	8	8
Sources of Class II or III leacheable contaminants or	YES	5	4	3	
4 Points Maximum		4	4	3	
Zone 1B contains or intercepts a Group 1 Area	NO Less Than 25% Agricultural Land	0	0	0	0
Land use Zone 1B	Less man 25% Agricultural Land				
Total Potential C	ontaminant Source / Land Use Score - Zone 1B	12	12	11	8
Potential Contaminant / Land Use - ZONE II					
Contaminant Sources Present	NO	0	0	0	
Sources of Class II or III leacheable contaminants or	NO	0	0	0	
Land Use Zone II	Less than 25% Agricultural Land	0	0	0	
Potential Co	ntaminant Source / Land Use Score - Zone II	0	0	0	0
Potential Contaminant / Land Use - ZONE III					
Contaminant Source Present	YES	1	1	1	
Sources of Class II or III leacheable contaminants or	YES	1	1	1	
Is there irrigated agricultural lands that occupy > 50% of	NO	0	0	0	
	ntaminant Source / Land Use Score - Zone III	2	2	2	0
Cumulative Potential Contaminant / Land Use Score		16	14	15	8
. Final Susceptibility Source Score		11	9	10	10
Final Well Ranking			Moderate	High	Modera